

TRANSPORTATION SECTION

BACKGROUND

The transportation sector in California causes significant greenhouse gas emissions, and transportation will play an extremely important role in meeting California's long-term GHG reduction goals. Transportation also contributes nearly half of air pollutants contributing to ozone and fine particulate pollution in areas such as the South Coast Air Quality Management District. California has long been a leader in clean transportation technology, and successes in California's efforts to reduce greenhouse gases are likely to be tracked by decision-makers both in the United States and internationally.

In addition, responding effectively to market opportunities and federal spending on advanced vehicle technology development offers important opportunities to expand the state's "Green" jobs. California has significant "innovation" capital and capacity, a culture of "early adopters" such as with hybrid passenger cars, and the capability to manufacture clean transportation technologies at scale. In addition, transitioning to more efficient transportation will also reduce an important cost for businesses in the state.

The intent of this section is to help update our knowledge of developments in this sector, both in terms of policies as well as economic developments since the publication of the original report. Thus the importance to California and federal stimulus monies or advanced factory development as well as electric vehicle development demonstrations is discussed in the following sections.

This section of the report also recognizes the difference between some of the shorter-term actions, actions required for longer-term planning and their impact on job creation. CALSTART has identified over 200 California companies and organizations supporting California's clean transportation industry.¹ The refinement of conventional technologies is unlikely to lead to the same level of California job creation as technology capable of dramatic reductions of greenhouse gases. In addition to job creation on the vehicle side, the next generation of technologies involving plug-in hybrid electric vehicles, factory electric vehicles and fuel-cell electric vehicles will all require substantial infrastructure improvements and developments. This in turn will also lead to significant additional opportunities for creation of high quality jobs and dollars retained within the California economy instead of exported to purchase imported energy supplies.

LIGHT DUTY VEHICLES

NEAR-TERM STRATEGIES

The US EPA is expected to establish GHG standards (working with the US Department of Transportation, which is responsible for fuel-economy standards)

¹ CALSTART, Clean Transportation Technology in California, 2009

through 2016 that are as strict as those set by CARB. These standards will most likely be met with improved conventional technology, combined with increasing shares of hybrids over time. Proposed regulations are expected by the end of August. The introduction of advanced electric drive technologies is expected to occur during the timeframe of these standards, but will have the greatest impact over a longer timeframe as discussed further below.

The results of another near-term program, the “cash for clunkers” incentive, are not yet available. Given that the minimum fuel economy levels for new vehicles are set below the level that will be required within a few years this program is most likely to remove older vehicles from the road through fleet turn-over without any significant incentive for technology innovation. A better alternative for advanced technology development would be “feebates” that create an incentive for cleaner vehicles while assessing a charge on less-efficient vehicles. Long-term “feebates” would encourage risk-adverse manufacturers to invest in R&D and offer more fuel-efficient types of vehicles, with a stable price signal for efficiency even after manufacturers meet minimum standards (an ICCT report on feebates is in development). The level of the incentive would increase for the most efficient vehicles, creating a technology-neutral market “pull” for advanced technology development to complement technology-specific efforts listed below.

California has offered a package of incentives to keep the NUMMI plant in Fremont operating after the departure of GM from the former GM-Toyota partnership. The plant has a capacity to produce several hundred thousand vehicles per year, and while future plans are uncertain it would provide potential for shifting to large-scale manufacturing for large-scale advanced technologies vehicles at some point in the future.

LONG-TERM STRATEGIES FOR GHG REDUCTIONS

California has a variety of regulatory programs to address both greenhouse gases and conventional pollutants. Currently CARB staff are developing a strategy to integrate the greenhouse gas and a zero emission vehicle programs. According to CARB’s Tom Cackette, (Endicott House, August 2009) his staff is working on a multi-phased approach to reach the 80% reduction in greenhouse gases by 2050, which also requires a 28% reduction in 2020 from 1990 levels. The specific actions required are:

- increase in fuel efficiency by a factor of three.
- transition from petroleum to ultralow carbon fuels.
- This transition to ultralow carbon fuels will require the transition to electric drive
- reduction in the vehicle miles traveled by about 20%

The implementation of these strategies should consider opportunities for technological growth, leadership and job creation in California. The existing programs to build upon and further develop existing technologies while leading to significant reduction in greenhouse gases will not hurt job creation in California. Thus, in the transportation sector, only when the introduction of electric drive and Decarbonization of fuels, particularly focusing on electricity and hydrogen, will we see substantial job creations in California. Therefore, it is critical that the transportation program in California see a continuing and consistent strategy, coupled with adequate funding, so that the industry can respond in a way that can guarantee some certainty about implementation. For example, as discussed below, in addition to strong regulations, which are typically implemented over a period of years, market mechanisms such as those incorporated in a "feebate" system can provide immediate fiscal incentives.

Such a system will provide the industry with correct market signals for investment in these advanced technologies and a return on their investments in successful technology development.

Electric-drive technologies overview

As stated above, the requirement for an 80% reduction in greenhouse gases by 2050 will drive the introduction of advanced technologies into the light duty fleet in California. In the near term, it is anticipated that conventional hybrid electric vehicles will continue to be the dominant form of electric-drive vehicle in the fleet. These will not require off board charging up the batteries. As we move to greater electrification, such as Plug-in Electric Vehicles (PHEV), Battery Electric Vehicles (BEV), and Fuel Cell Electric Vehicles (FCEV), there will be increasing need for the development of infrastructure to provide for the electricity to recharge factories and to handle hydrogen. According to the California air resources Board, by 2050 over two thirds of on-road vehicles with full range capacity will be powered by electricity or hydrogen. The implications of this strategy is discussed below.

It is recognized that there will be additional costs per vehicle for the introduction of these advanced technologies. Figure 1 (to be added) shows an estimate carried out by MIT comparing the cost of different electric drive vehicles, showing that the incremental costs of BEVs, PHEVs, FCEV. The differential costs are assumed to be those in mass production. Already there are incentives in place to offset the cost the cost differential of these vehicles which will facilitate their entry into the marketplace discussed below.

A substantial investment in battery technology being provided both by the federal government and other governments noted below will accelerate the introduction of electric drive transportation in California in addition to the regulations that will promote an increased use of electric drive vehicles to meet stringent greenhouse gas goals. Such a change in the motor vehicle fleet is likely to lead to significant opportunities for job creation in California. In addition to the increasing investment in research and electric drive components and manufacturing of these components in California, companies such as Tesla are beginning to produce electric vehicles in California and Tesla has received

significant federal funding to scale-up operations. The required change in infrastructure as a result of the increasing numbers of electric and fuel cell vehicles, will provide significant additional job growth opportunities throughout California.

The increasing use of privatization and electric drive will also be seen in parts of a heavy-duty sector, particularly for buses. This change is already happening in California with hybrids, pure electric and fuel cell vehicles.

The global electric passenger vehicle technology race

Competition to develop and manufacture electric passenger vehicles is a global technology race with well over \$12 billion in investments identified to develop battery electric (including plug-ins) vehicles committed globally since the original ETAAC report.

The United States is providing a massive surge of funding. The federal government and states such as Michigan and Kentucky (and to a lesser extent California) combined will spend \$7.2 billion on manufacturing, federal tax credits up to \$7,500 per vehicles, and demonstrations of electric vehicles and charging infrastructure. Matching private dollars for grants and pending "Clean Cities" awards for transportation electrification will boost that total close to if not over \$10 billion - not including the portion of public loans keeping GM and Chrysler afloat that are also used for this purpose. The federal climate bill passed by the House of representative could provide billions of dollars in additional funding beginning as soon as 2011.

The first round of \$2 billion in federal grants and private matching dollars (announced in June 2009) is intended to result in the production of 170,000 electric vehicles (most of which will be electric vehicles with a 100-mile range) and an additional 10,000 battery packs. Specifics of a second round of \$1.5 billion worth of loans awarded in August are not yet available.

While ETAAC has not independently researched capital costs, these loan, grants, and matching funds should provide sufficient capital investment for at least several hundred thousand PHEV-40 battery packs and perhaps a million or more PHEV-15 battery packs annually. Thus, remaining challenges on the vehicle side will likely remain on bringing down technologies costs - with \$500/KW-hr a key target set by the Department of Energy - and increasing performance through addition research and successful manufacturing at scale.

European and Asian governments in countries with significant auto manufacturing are also investing billions into electric drive vehicle manufacturing (as noted in the Appendix) and will compete with manufacturers in California and the United States. Japanese companies have a strong lead in advanced battery manufacturing for other applications, but are under pressure on the automotive side. China is hoping to "leapfrog" existing conventional automotive technology where it is less competitive into electric-drive vehicles and battery manufacturing through purchase subsidies

and other incentives. South Korea is forming its own consortium, and LG Chem has announced separately that it will invest a total of Won 1tr (US\$799m) in manufacturing EV batteries for GM in the US by 2013. Germany, France, and the United Kingdom are also each investing upwards of half a billion dollars to develop electric vehicle technology.

Looking longer term, Congress has re-established funding for hydrogen fuel cell technology that DOE reports has made important steps towards commercialization. Fuel cells share many of the components of battery electric-drive vehicles, so expanding commercialization for EVs and PHEVs will likely facilitate fuels cells by driving down those costs. While EVs and PHEVs are potential competing technologies with fuel cells, neither is likely to dominate sales between now and 2020 leaving room for the potential emergence of multiple technologies.

Policy Recommendations for California Regarding Electric-Drive Technology:

The most important role for California is to encourage technology development is likely to center on providing markets and successfully demonstrating new technology to complement global investment in manufacturing (and R&D). For example, charging stations will be funded with \$22 million in Proposition 118 funding and a number of cities have requested federal funding. The South Coast AQMD has received an award to demonstrate this technology in California and nationally for several hundred medium-duty vehicles. (State-level encouragement of manufacturing is likely to be an economic development strategy rather than playing a critical role in addressing capital availability for technology development given the scale of existing global investments in manufacturing.) California has been a leader on the introduction of new technologies such as hybrid vehicles and can play a similar role for other advanced technologies as they become available for deployment.

Infrastructure deployment is also complementary to California's mandates to deploy electric-drive EVs/PHEVs and should help to integrate intermittent renewable resources like wind into California's electric grid (see section X of the report) with the right policies and infrastructure in place to promote off-peak charging. (insert Calstart table of refueling stations in California) In addition, California should receive preference in federal funding because its low-carbon grid will maximize GHG reductions compared to states with more coal and less renewables. Pavely II and ZEV rule development can provide a long-term market and incentive to demonstrate technologies in California.

It is critical that California recognizes the importance of providing strong and consistent regulatory standards and market signals so that the industry can plan its investments over a longer period of time without being subject to changes every few years.

The above discussion highlights the fact that AB 32 will require a dramatic reduction in greenhouse gases and a change in the technology and the marketplace. However it also assumes that the public will accept this new technology and buy the vehicles being provided. Based on past experience is his by no means a given. That's a key part of the

overall program is to educate the public on options and needs for such a transformation. Therefore ETAAC, as it did in its earlier report, strongly endorses a comprehensive outreach program so the California public is fully aware all of the challenges posed by climate change and the actions required to mitigate or adapt to those changes.

ADVANCED BIOFUELS STATUS

(This section is under development)

HEAVY DUTY VEHICLES

IMMEDIATE OPPORTUNITY FOR RETROFITS TO ADDRESS BLACK CARBON AND GREENHOUSE GAS REDUCTION

It is well recognized that the diesel particulate presents a significant health hazard and has been identified in California as a toxic air contaminant. These fine particle emissions typically referred to as PM 2.5 are emitted from combustion sources. Black carbon is the solid fraction of PM 2.5 that strongly absorbs light and converts that energy to heat. When emitted into the atmosphere and deposited on ice or snow Black Carbon contributes to global temperature change, geographic landmass of snow and ice and changing precipitation patterns. According to IPCC, black carbon is also the third-largest contributor to positive radiative forcing on climate change. Hence given the many sources of all particulate emissions from the transportation sector, especially the heavy-duty vehicle sector, reduction of these emissions could have a significant impact in reducing greenhouse gases. While black carbon has not been officially recognized within the pollutants defined in AB 32, there is growing evidence that it should be recognized as such.

California has a substantial heavy-duty vehicle retrofit program for particulate matter in place. The additional impetus given by recognizing the role of black carbon as a greenhouse gas should lead to the acceleration of programs for heavy-duty vehicles and off-road sources in California. It is well recognized that this could lead to continuing significant job creation and that these jobs would be generated in California.

The International Council on Clean Transportation has recently prepared a report addressing the role of black carbon in climate change. This paper, provided in the Appendix, lays out the basis for actions to reduce black carbon emissions into the atmosphere. This provides the background for the need to accelerate black carbon emissions in California. (The California Air Resources Board has extensive documentation on the role of fine particles in causing well over ten thousand excess deaths in California every year²)

(Additional recommendations for heavy duty vehicles are under consideration)

² <http://www.arb.ca.gov/research/health/pm-mort/pm-mort.htm>